High Performance Components

Distributed Exhaust Nozzles

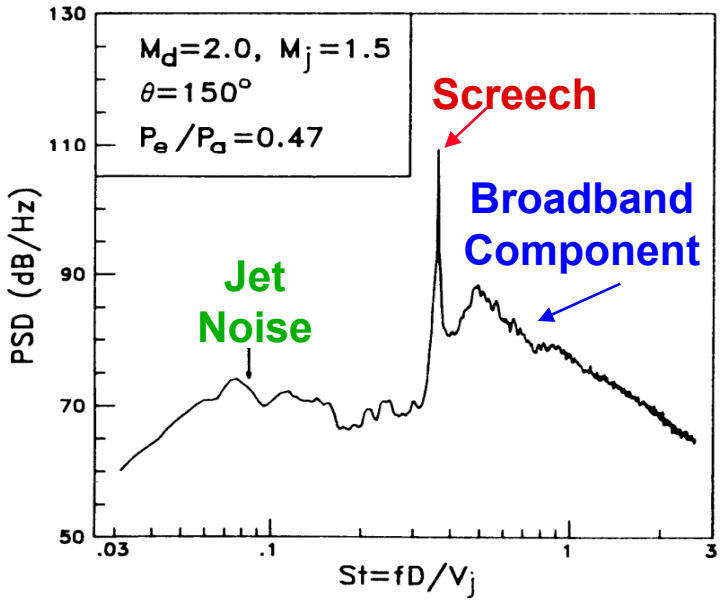
Lead: Krish Ahuja

Collaborators: Dr. Gaeta, One student

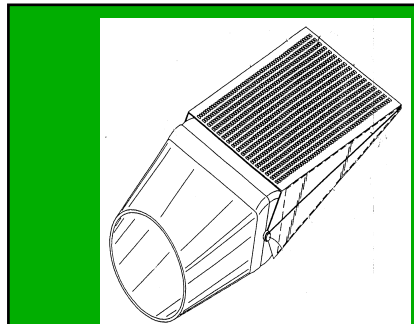
Project Duration: 5 Years

Motivation and Objectives

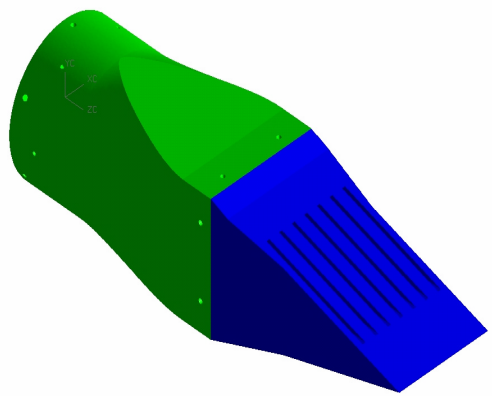
- Aero-engine propulsion system noise continues to be a show stopper for the aviation industry
- Innovative nozzle designs needed to reduce jet noise
- A recent concept of distributed nozzle exhaust studied by Georgia Tech in conjunction with Northrop Grumman has considerable potential of low farfield noise, but many issues remain



- Jet can shield noise
- Coalescing jets at low velocities produces less noise
- Inaudible sound of smaller nozzles



From Northrop Grumman Patent



- Fluid Shielding
- Trailing Edge Effects
- Flight Effects

Approach

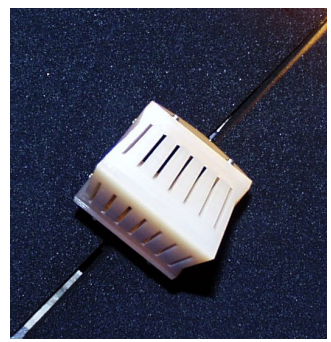
Basis

- Smaller jets produce inaudible sound
- If spaced suitably, the jets coalesce at smaller velocities, thus producing low-amplitude noise at low frequencies

Key:

Optimized nozzle spacing, fluid shielding, thrust performance, and flight effects

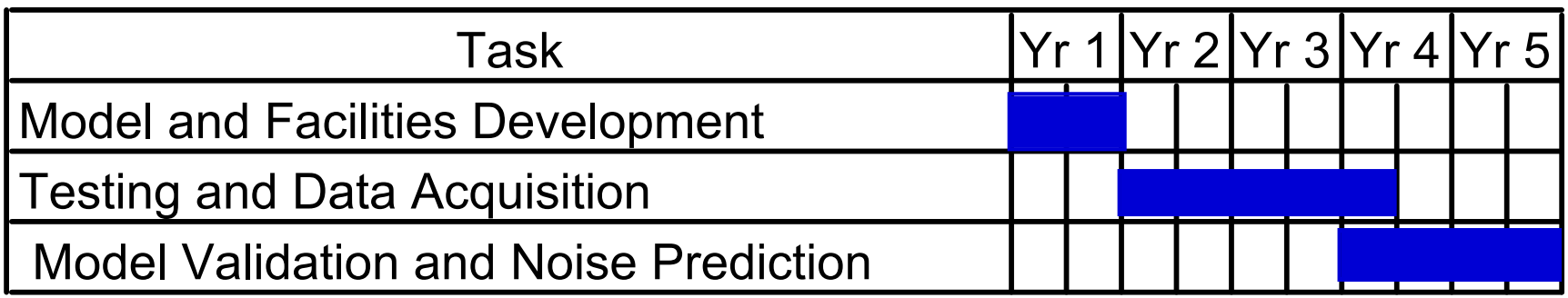
- Design and fabricate a nozzle with different wedge geometries
- Perform tests in an anechoic flight simulation facility
- Measure farfield noise, flow visualization, and PIV data
- Correlate results where possible with theoretical/CAA models and develop a noise prediction scheme



The approach will build upon the results of a recent successful grant from Glenn on similar work

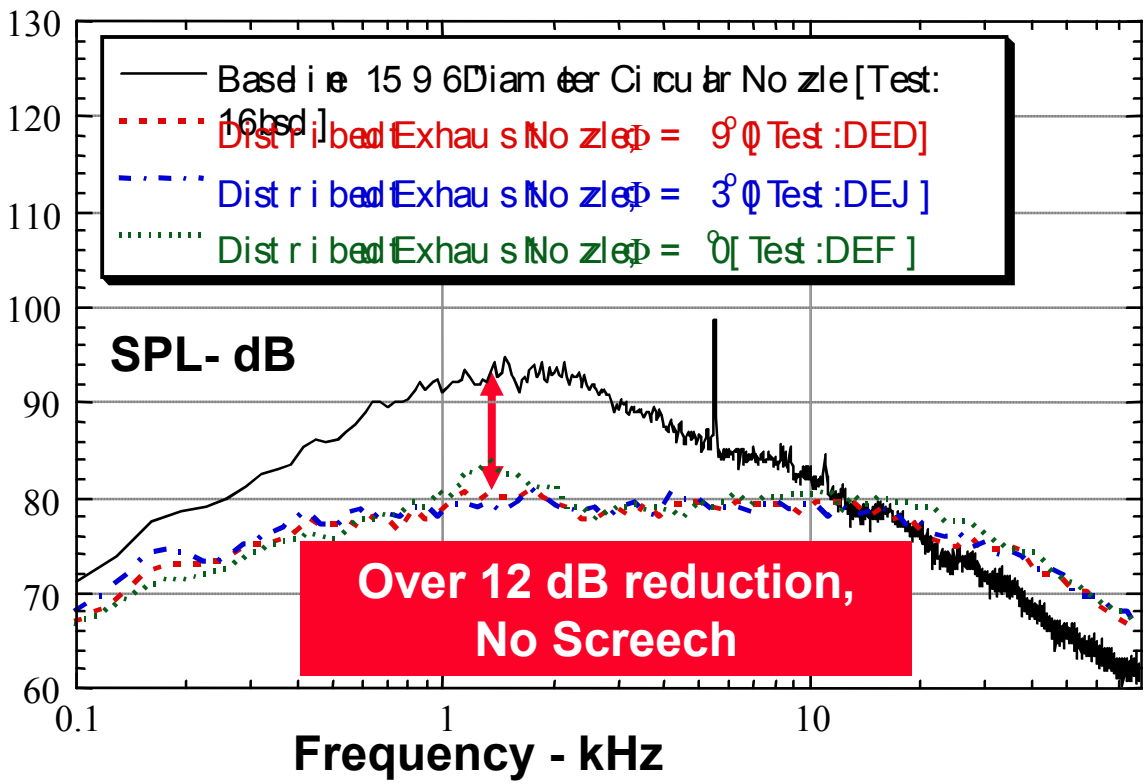
Milestones and Expected Accomplishments

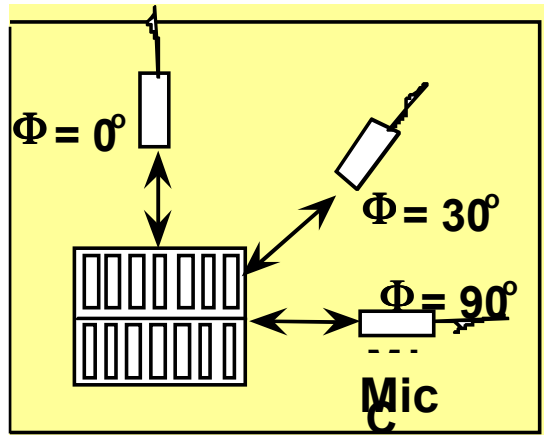
- Benchmark data for a distributed exhaust nozzle in an anechoic chamber using an aeroacoustically clean jet flow facility
- Understanding of mixing and noise performance of a futuristic suppressor nozzle
- Understanding of fluid shielding
- Correlation of the data, where possible, with theoretical/ CAA models



Chances of Success

- Chances of success are very high
- Initial static tests extremely promising





- Nozzle Pressure Ratio: 2.45
- Unheated
- Exit Velocity: 1157ft/sec
- Mic at polar angle 30 °